

Procedure for Calculating Responsive Reserve (RRS) Limits for Individual Resources

**Version 1.0**

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Protocol Disclaimer

This document describes ERCOT Systems and the response of these systems to Market Participant submissions incidental to the conduct of operations in the ERCOT Texas Nodal Market implementation and is not intended to be a substitute for the ERCOT Nodal Protocols (available at http://www.ercot.com/mktrules/nprotocols/current), as amended from time to time. If any conflict exists between this document and the ERCOT Nodal Protocols, the ERCOT Nodal Protocols shall control in all respects.

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Introduction

Nodal Operating Guide Section 2.3.1.2.1, Limit on Generation Resources and Controllable Load Resources Providing RRS, requires that ERCOT develop a TAC-approved procedure that describes the methodology to calculate megawatt (MW) limits for Resources providing Responsive Reserve (RRS).

Change Control Process

The Performance, Disturbance, Compliance Working Group (PDCWG) is responsible for maintaining and updating the “*Procedure for Calculating Responsive Reserve (RRS) Limits for Individual Resources”*. Changes to this document shall be reviewed by the PDCWG and Reliability and Operations Subcommittee (ROS) prior to approval by the Technical Advisory Committee (TAC).

In the following cases, after review and recommendation by TAC, revisions to this document must be approved by the ERCOT Board:

a. The revisions require an ERCOT project for implementation; and

b. The revisions are related to a Nodal Protocol Revision Request (NPRR), a Planning Guide Revision Request (PGRR), or a revision request requiring an ERCOT project for implementation.

Upon approval of revisions, ERCOT shall post the revised procedure to the ERCOT website within three Business Days.

Responsive Reserve Service

Response Reserve (RRS) is an operating reserve on Generation Resources, Load Resources, and Resources capable of providing Fast Frequency Response (FFR) maintained by ERCOT to help control the frequency of the system. RRS on Generation Resources and Controllable Load Resources that are capable of providing Primary Frequency Response can be released to Security-Constrained Economic Dispatch (SCED) during scarcity conditions as outlined in Nodal Operating Guide Section 4.8, Responsive Reserve Service During Scarcity Conditions.

# RRS MW Limits for Individual Resources

Thermal Resources that do not meet the 12 months or the last eight Frequency Measurable Events (FMEs) (applicable if a minimum threshold of eight FMEs within the 12 month period is not met) rolling average criteria, or have failed to score greater than or equal to 0.75 for Primary Frequency Response initial or Primary Frequency Response sustained measures (computed per Nodal Operating Guide Section 8J, Initial and Sustained Measurements for Primary Frequency Response) for three consecutive FMEs, where the unit was evaluated, over a minimum period of two calendar months, will be subject to review of their respective RRS limit using the process outlined in Section 5 below. All other thermal Resources shall continue to be limited to 20% of their respective High Sustained Limit (HSL) as their RRS limit.

The default MW limit for any new thermal Generation Resource or Controllable Load Resource providing RRS shall be set to 20% of its HSL or Maximum Power Consumption (MPC), as appropriate. A Private Use Network with a registered Resource may use its gross HSL for qualifying and establishing a limit on the amount of RRS capacity that the Resources within the Private Use Network can provide.

RRS limits for non-thermal Resources or Generation Resources with a Resource Category of either (i) aeroderivative simple cycle commissioned after 1996, or (ii) Reciprocating Engines may be updated to be higher or lower than 20% threshold based on their droop performance characteristics, actual tests, and the need to keep the frequency responsive capability fairly distributed across multiple Resources. Based on Protocol Section 3.18, Resource Limits in Providing Ancillary Service, Hydro Resources operating in synchronous condenser fast-response mode may provide RRS up to the hydro Generation Resources proven 20-second response capability (which may be 100% of their HSL).

# Calculating RRS MW Limits for Individual Resources

For Resources that fail the Primary Frequency Response initial or Primary Frequency Response sustained measures for three consecutive FMEs, where the unit was evaluated, over a minimum period of two calendar months or are failing the 12 months or the last eight FMEs (applicable if a minimum threshold of eight FMEs within the 12 month period is not met) rolling average criteria, ERCOT shall establish MW limit for providing RRS based on their respective performance during FMEs, any limitations exhibited within its dynamic models, or through droop performance tests on as needed basis.

If the RRS limit is to be determined based upon the Resource’s performance during an FME, then such RRS limit shall be calculated as follows,

1. The MW Limit for each Generation Resource and Controllable Load Resource will be calculated using the droop performance during an FME. The Calculated Droop Performance and RRS MW Limit for an FME is calculated as follows:

$$Calculated Droop Performance (Droop)=\frac{(HSL PA Capacity) \*(∆Hz -Deadband\_{max})}{ScheduledFrequency \* ∆MW}$$

$$Calculated RRS MW Limit= \frac{0.01\*ScheduledFrequency}{ScheduledFrequency\*Droop-Deadband\_{max}}$$

**Delta Hertz (∆Hz):** The pre-perturbation [the 16-second period of time before t(0)] average frequency minus the post-perturbation [the 32-second period of time starting 20 seconds after t(0)] average frequency

**Delta MW (∆MW):** The pre-perturbation average MW of the Resource minus the post-perturbation average MW of the Resource

**Scheduled Frequency:** The frequency value to be maintained on the system, always 60 Hz

**Power Augmentation (PA) Capacity:** The telemetered portion of a Generation Resource’s HSL that represents the sustainable non-Dispatched power augmentation capability from duct firing, inlet air cooling, auxiliary boilers, or other methods which does not immediately respond, arrest, or stabilize frequency excursions during the first minutes following a disturbance without secondary frequency response or instructions from ERCOT

**Deadband (Deadbandmax):** The range of deviations of system frequency (+/-) that produces no PFR

1. The median of the calculated MW Limits in the last five FMEs will be computed for each individual Generation Resource and Controllable Load Resource. If Resource hasn’t participated in five FMEs, proceed to Step 3.
2. The median of all FMEs during previous three months will be computed for each individual Generation Resource and Controllable Load Resource.
3. RRS MW limit will be established based on lower of the values computed in Steps 2 and 3.

If a Generation Resource’s or Controllable Load Resource’s performance during an FME is excluded per the current process (NERC Reliability Standard BAL-TRE-001) from the rolling average calculation, the Resource’s performance will also be excluded from the RRS MW Limit calculation. Also note that all members of a Combined Cycle Generation Resource will be evaluated as one Generation Resource for the purposes of this evaluation.

# Timeline to Establish RRS MW Limits

ERCOT will recalculate the MW Limit on each individual Generation Resource and Controllable Load Resource on a monthly basis. ERCOT shall post on the Market Information System (MIS) Certified area the MW limit for each Resource qualified to provide RRS by the 10th day of each month. These RRS limits will be effective in ERCOT systems coincident with first Network Model database load[[1]](#footnote-1) two months later. For example, ERCOT shall post the MW Limit for each Resource by January 10, 2020. These RRS Limits will be effective in ERCOT systems beginning March 4, 2020. These recalculated values will follow any threshold limitations as expressed in Section 4 above.

If at the time of recalculation, a Generating Resource or Controllable Load Resource was previously limited due to any failure mentioned in Section 5, then the established RRS limit will continue to apply. In order to reset the RRS limit, Generation Resource or Controllable Load Resource may use dynamic models, droop performance tests, or documentation of an implemented corrective action plan to demonstrate that it is capable of carrying standard RRS limit as mentioned in Section 4.

# Appendix RRS Limit Decision Tree

The diagram below describes at a high level the decision tree this procedure will compute a RRS limit for every Generation Resource. In the event there is a conflict between the diagram below and text stated in the sections above, the language stated in text above takes precedence.

\*failed rolling average or score in last three evaluated events in two consecutive months < 0.75

Monthly RRS Limit Calculation for a Generation Resource

Is the Generation Resource currently limited due to previous failure?

Entry criteria\* met?

Compute new RRS Limit and post

Corrective Actions Complete?

Set RRS Limit to 20% and post

RRS Limit remains unchanged at prior limited value and post

Y

Y

Y

N

N

N

1. The most recent Network Model Database Load Schedules can be accessed at the following link.

<http://www.ercot.com/gridinfo/transmission/opsys-change-schedule.html> [↑](#footnote-ref-1)